Drying shrinkage stresses in concrete patch repair systems

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Abstract: This paper proposes an approach to prediction of the build-up of stresses due to drying shrinkage in concrete patch repair systems. The technique suggested consists of a twofold sequential approach, requiring the solution of the moisture diffusion equation followed by execution of an appropriate stress analysis program. Solution of the non-linear moisture diffusion problem is obtained conveniently through a finite element formulation, which outputs the variation of moisture content in time and space. Inasmuch as drying shrinkage occurs by virtue of loss of moisture, a phenomenological relationship between moisture loss and free shrinkage strain is established and used to convert the finite element output of moisture loss to the free shrinkage strain. Time- and space-dependent values of free shrinkage strain are then fed as input to an appropriate stress analysis program, conceptually similar to a thermal stress analysis program, with the resulting output yielding the sMss build-up in the patch repair system due to drying shrinkage. The influence of repair layer variables including the diffusivity Kc, ultimate free shrinkage strain εsh and modulus of elasticity Er on the build-up of drying shrinkage stress is highlighted.